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Abstract

MILD STEEL IN PRIMARY CIRCUITS OF WATER COOLED POWER REACTORS

by

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Evaluation of the possibilities for substituting stainless steels with normal boiler steels in a water cooled power reactor requires knowledge of the quality of the water and the steam in every part of the system and the behaviour of the steel in these environments. The present survey deals mainly with corrosion and purification problems in a mild steel system and the considerations are based on a direct cycle boiling water reactor.

The steam from a boiling water reactor will normally contain from 5 - 20 ppm oxygen. It is possible to reduce the oxygen content by injecting hydrogen in the reactor. It is also possible to raise the pH to values used in conventional plants by adding ammonia. However, results from experiments carried out in HBWR (covered in a special paper at this conference) show that a very high dosage of hydrogen is required in both cases. It would be a more attractive solution if mild steel could be applied in neutral water with radiolytic oxygen and hydrogen present.

A series of corrosion experiments in out-of-pile loops both at high and low temperatures have been carried out to this end, and the results are compared with litterature data and with corrosion experiments carried out in a boiling water power reactor (HBWR). Special effort has been devoted to the study of the effect of the oxygen content and pH, and of methods for preconditioning of the steels in order to minimize the corrosion and corrosion product release.

It is concluded that the high temperature corrosion resistance of normal boiler steel in boiling water reactor environment is acceptable and that corrosion of components at low temperature and attack during shut down on parts normally at high temperatures are the problems most difficult to handle.

In all circumstances the application of carbon steel or low alloy steels will result in more corrosion products being given off to the water and a more effective purification system is required.